

DOCKET NO.: 257913US6PCT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

IN RE APPLICATION OF: Tajinder MANKU

SERIAL NO.: NEW U.S. PCT APPLICATION

FILED: HEREWITH

INTERNATIONAL APPLICATION NO.: PCT/CA03/00256

INTERNATIONAL FILING DATE: February 25, 2003

FOR: METHOD AND APPARATUS FOR DOWN CONVERSION OF RADIO FREQUENCY (RF) SIGNALS

**REQUEST FOR PRIORITY UNDER 35 U.S.C. 119 (e)
AND THE INTERNATIONAL CONVENTION**Commissioner for Patents
Alexandria, Virginia 22313

Sir:

In the matter of the above-identified application for patent, notice is hereby given that the applicant claims as priority:

<u>COUNTRY</u>	<u>APPLICATION NO</u>	<u>DAY/MONTH/YEAR</u>
USA	60/360,069	25 February 2002

Certified copies of the corresponding Convention application(s) were submitted to the International Bureau in PCT Application No. PCT/CA03/00256. Receipt of the certified copy(s) by the International Bureau in a timely manner under PCT Rule 17.1(a) has been acknowledged as evidenced by the attached PCT/IB/304.

Respectfully submitted,
OBLON, SPIVAK, McCLELLAND,
MAIER & NEUSTADT, P.C.



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10/505413

PC 03/ 00256

MARCH 2003 12-03-03

REC'D 28 MAR 2003

WFO PCT

PA 968541

THE UNITED STATES OF AMERICA

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UNITED STATES DEPARTMENT OF COMMERCE

United States Patent and Trademark Office

February 27, 2003

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APPLICATION NUMBER: 60/360,069

FILING DATE: February 25, 2002

PRIORITY DOCUMENT

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PTO/SB/18 (10-01)

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PROVISIONAL APPLICATION FOR PATENT COVER SHEET

This is a request for filing a PROVISIONAL APPLICATION FOR PATENT under 37 CFR 1.53 (c).

Express Mail Label No. EEL524029360US

INVENTOR(S)

Given Name (first and middle [if any])

Family Name or Surname

Residence
(City and either State or Foreign Country)

Tajinder

Manku

Waterloo, Ontario, Canada

☐ Additional Inventors are being named on the separately numbered sheets attached hereto

TITLE OF THE INVENTION (500 characters max)

IMPROVEMENTS IN DOWN CONVERSION

CORRESPONDENCE ADDRESS

Direct all correspondence to:

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20350

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ENCLOSED APPLICATION PARTS (check all that apply)☒ Specification Number of Pages

8

☐ CD(s), Number☐ Drawing(s) Number of Sheets☐ Other (specify)☒ Application Data Sheet. See 37 CFR 1.76**METHOD OF PAYMENT OF FILING FEES FOR THIS PROVISIONAL APPLICATION FOR PATENT**☐ Applicant claims small entity status. See 37 CFR 1.27.☐ A check or money order is enclosed to cover the filing feesFILING FEE
AMOUNT (\$)☒ The Commissioner is hereby authorized to charge filing
fees or credit any overpayment to Deposit Account Number:

20-1430

160

☐ Payment by credit card. Form PTO-2038 is attached.

The invention was made by an agency of the United States Government or under a contract with an agency of the United States Government.

☒ No.☐ Yes, the name of the U.S. Government agency and the Government contract number are:

Respectfully submitted,

SIGNATURE

Kenneth R. Allen

Date

2/25/02

REGISTRATION NO.

27,301

(If appropriate)

Docket Number:

085906

TYPED or PRINTED NAME Kenneth R. Allen

TELEPHONE 650-326-2400

USE ONLY FOR FILING A PROVISIONAL APPLICATION FOR PATENT

This collection of information is required by 37 CFR 1.51. The information is used by the public to file (and by the PTO to process) a provisional application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 8 hours to complete, including gathering, preparing, and submitting the complete provisional application to the PTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, Washington, D.C., 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Box Provisional Application, Assistant Commissioner for Patents, Washington, D.C. 20231.

PA 3203465 v1

Jc868 U.S. PTO
NO 105 112Jc879 U.S. PTO
60/360069

02/25/02

EEL524029360US

FEE TRANSMITTAL
for FY 2001

Patent fees are subject to annual revision.

TOTAL AMOUNT OF PAYMENT (\$) 160**Complete if Known**

Application Number	Unassigned
Filing Date	Herewith
First Named Inventor	Manku, Tajinder
Examiner Name	Unassigned
Group Art Unit	Unassigned
Attorney Docket No.	085906

METHOD OF PAYMENT

- 1.
- ☒
- The Commissioner is hereby authorized to charge indicated fees and credit any over payments to:

Deposit
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20-1430

Deposit
Account
Name

Townsend and Townsend and Crew LLP

- ☒
- Charge Any Additional Fee Required
-
- Under 37 CFR 1.16 and 1.17
-
- ☒
- Applicant claims small entity status.
-
- See 37 CFR 1.27

- 2.
- ☐
- Payment Enclosed:

☐ Check ☐ Credit card ☐ Money Order ☐ Other**FEE CALCULATION****1. BASIC FILING FEE**

Large Fee Code	Entity Fee (\$)	Small Fee Code	Entity Fee (\$)	Fee Description	Fee Paid
101	740	201	370	Utility filing fee	
106	330	206	165	Design filing fee	
107	510	207	255	Plant filing fee	
108	740	208	370	Reissue filing fee	
114	160	214	80	Provisional filing fee	160

SUBTOTAL (1)

(\$160)

2. EXTRA CLAIM FEES

Total Claims	Extra Claims	Fee from below	Fee Paid
-20**	X		
-3**	X		
Multiple Dependent	X		

Large Fee Code	Entity Fee (\$)	Small Fee Code	Entity Fee (\$)	Fee Description
103	18	203	9	Claims in excess of 20
102	84	202	42	Independent claims in excess of 3
104	280	204	140	Multiple dependent claim, if not paid
109	84	209	42	** Reissue independent claims over original patent
110	18	210	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2)

(\$)

**or number previously paid, if greater; For Reissues, see above

FEE CALCULATION (continued)**3. ADDITIONAL FEES**

Large Fee Code	Entity Fee (\$)	Small Fee Code	Entity Fee (\$)	Fee Description	Fee Paid
105	130	205	65	Surcharge - late filing fee or oath	
127	50	227	25	Surcharge - late provisional filing fee or cover sheet	
139	130	139	130	Non-English specification	
147	2,520	147	2,520	For filing a request for reexamination	
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	
115	110	215	55	Extension for reply within first month	
116	400	216	200	Extension for reply within second month	
117	920	217	460	Extension for reply within third month	
118	1,440	218	720	Extension for reply within fourth month	
128	1,980	228	980	Extension for reply within fifth month	
119	320	219	160	Notice of Appeal	
120	320	220	160	Filing a brief in support of an appeal	
121	280	221	140	Request for oral hearing	
138	1,510	138	1,510	Petition to institute a public use proceeding	
140	110	240	55	Petition to revive - unavoidable	
141	1,280	241	640	Petition to revive - unintentional	
142	1,280	242	640	Utility issue fee (or reissue)	
143	460	243	230	Design issue fee	
144	620	244	310	Plant issue fee	
122	130	122	130	Petitions to the Commissioner	
123	50	123	50	Petitions related to provisional applications	
126	180	126	180	Submission of Information Disclosure Stmt	
581	40	581	40	Recording each patent assignment per property (times number of properties)	
146	740	246	370	Filing a submission after final rejection (37 CFR § 1.129(a))	
149	740	249	370	For each additional invention to be examined (37 CFR § 1.129(b))	
179	740	279	370	Request for Continued Examination (RCE)	
169	900	169	900	Request for expedited examination of a design application	

Other fee (specify)

The Commissioner is authorized to charge any additional fees to the above noted Deposit Account.

*Reduced by Basic Filing Fees Paid

SUBTOTAL (3)

(\$)

SUBMITTED BY

Name (Print/Type)

Kenneth R. Allen

Registration No. (Attorney/Agent)

27,301

Telephone

650-326-2400

Signature

Kenneth R. Allen

Date

February 25, 2002

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Application Data Sheet

Application Information

Application number::

Filing Date::

Herewith

Application Type::

Provisional

Subject Matter::

Utility

Suggested classification::

Suggested Group Art Unit::

CD-ROM or CD-R??::

Number of CD disks::

Number of copies of CDs::

Sequence Submission::

Computer Readable Form (CRF)?::

Number of copies of CRF::

Title::

IMPROVEMENTS IN DOWN CONVERSION

Attorney Docket Number::

085906

Request for Early Publication::

No

Request for Non-Publication::

No

Suggested Drawing Figure::

Total Drawing Sheets::

Small Entity?::

No

Latin name::

Variety denomination name::

Petition included?::

No

Petition Type::

Licensed US Govt. Agency::

Contract or Grant Numbers One::

Secrecy Order in Parent Appl.::

No

Applicant Information

Applicant Authority Type:: Inventor
Primary Citizenship Country:: Canada
Status:: Full Capacity
Given Name:: Tajinder
Middle Name::
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State or Province of Residence:: Ontario
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State or Province of mailing address:: Ontario
Country of mailing address:: Canada
Postal or Zip Code of mailing address:: N2L 6M7

Correspondence Information

Correspondence Customer Number:: 20350

Representative Information

Representative Designation::	Representative Number::	Representative Name::
Primary	27,301	Kenneth R. Allen

TITLE OF INVENTION: Improvements in down conversion

SUBMITTED BY: Tajinder Manku

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ADDRESS:

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460 Phillip Street
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N2L 5J2
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fax - 519-747-3996

Please Answer the following questions and attach any documents/publications/disclosures:

1. Discuss the relevant area or areas of technology.

The invention is relevant in the area of integrated radio receivers. The invention is a method of integrating a down convertor within CMOS technology.

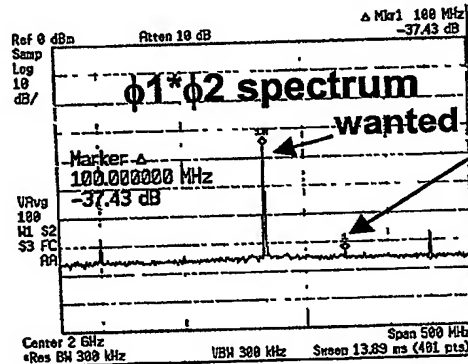
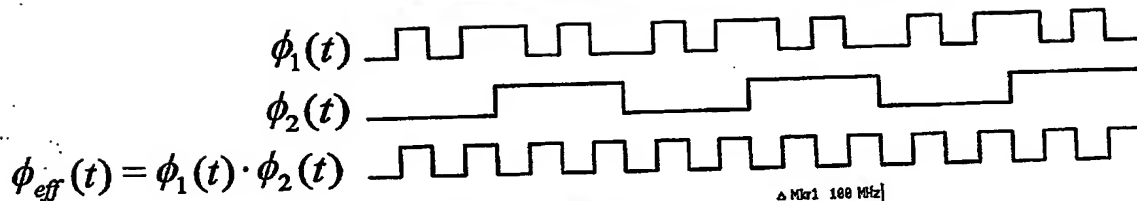
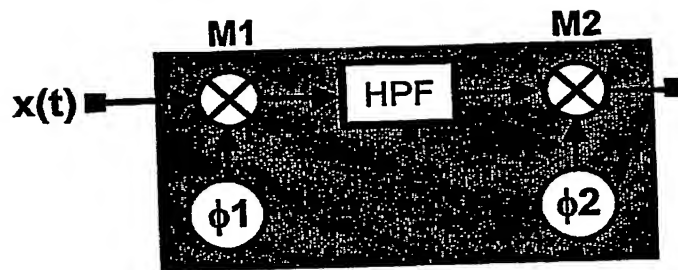
2. What problem or problems exist that your invention may solve?

SiRiFiC's RX technology consists of two mixers connected together via a HPF. At the LO ports of the two mixers (labeled M1 and M2) the signals $\phi 1$ and $\phi 2$ are applied such that the overall RF signal (denoted as $x(t)$) is multiplied by a signal having significant power at the RF carrier frequency; that is $\phi 1 * \phi 2$ has significant power at the RF frequency. However in reality there will be power generated in places other than the RF carrier frequency – denote this power as unwanted power – this can be seen in the figure below. This amount of unwanted power can be controlled via the time delay and frequency of signal $\phi 2$. The unwanted power will down convert signals located at the “unwanted power frequencies”. For example, if there is unwanted power at 2100MHz and there is an out of band RF signal at 2100MHz, this RF signal will be down

converted on top of the wanted signal. However, this down converted power will be attenuated by the difference between "the power of the wanted" minus "the power of the unwanted" (for the figure below this is ~37dB) – denote this amount as WmU (Wanted minus Unwanted). If RF_{wanted} denotes the wanted RF power, the total amount of power at base band is approximately:

$$BBpower = RF_{wanted} + 10^{(-WmU/10)} RF_{unwanted}$$

There are three ways to fix this problem – (i) increasing the value of WM (ii) adjusting the frequency of $\phi 2$ such that the $RF_{unwanted}$ tone does not fall on top of the wanted signal at base band, (iii) frequency hopping $\phi 2$ so that probability of $RF_{unwanted}$ tone falling on top of the wanted signal significantly reduces. In either approach the $BBpower$ is minimized as a function of the variables in (i) or (ii). The document addresses solution (i) and (ii). Also the document addresses generating $\phi 1$ using a LO that is not tuned at the carrier frequency along with a regenerative divider.

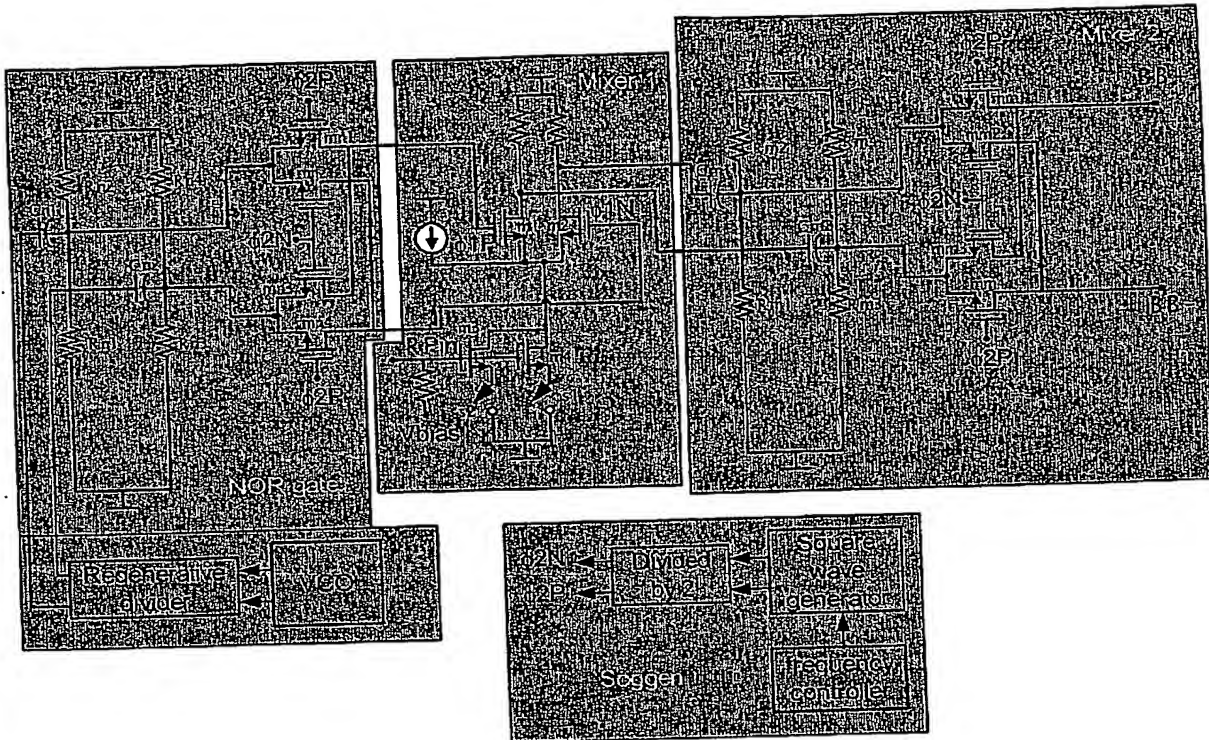


3. What are the advantages of your invention?

Key points (see circuit in question 4):

- Reduces spurious problems by reducing W_m
- After the regenerative divider the signal has a large frequency component at the RF carrier frequency. The regenerative divider also may be replaced by a divide or multiply by N element
- A high pass filter is absorbed in mixer2 to reduce DC offsets.

4. Explain, in detail, preferably with the assistance of drawings or flowcharts, the best embodiments or examples of your invention. Include a list of components, if appropriate.



- Mixer 1 is a down conversion mixer. It may be different than the one depicted in the figure above. Mixer2 is the second mixer and is passive and has absorbed a high pass filter (i.e. components R_{m2} , R_{m1} , C_{m2} , R_{m4} , R_{m3} , and C_{m1}).
- The switches s_2 and s_1 change the gain of the mixer1.
- The NOR gate helps generate ϕ_1 and is designed similar to the Mix2. The degree of symmetry between the NOR gate and mixer2 helps increase the value of W_m .
- ϕ_1 is also generated with the help of a VCO (i.e. LO) that is not tuned at the carrier frequency and a regenerative divider or a divided by N circuit. The VCO may be an off chip component.
- The signal ϕ_2 is generated using a divided by 2 element to ensure that ϕ_2 has a ~50% duty cycle. Also there is a frequency controller to generating ϕ_2 that may enable ϕ_2 to hop from one frequency to another. This reduces the probability of $\phi_1 * \phi_2$ having power at an unwanted frequency. (the rate of hopping should be at least greater than the data/symbol rate of the data).

5. Repeat item (4) above, for any other important embodiments or examples of your invention.

- The circuits above can be implement using bipolar technology, CMOS technology, BiCMOS technology, or another semiconductor technology.
- The regenerative circuit may be replaced by a divided by N element.
- Any other mixer described in the art may replace Mixer1.
- A poly-phase filter may be replaced between the regenerative circuit and the NOR gate inputs or absorbed in the regenerative circuit

6. What are the important elements of the preferred embodiment of your invention?

- The NOR gate circuit is similar to the mixer 2 circuitry in terms of structure and/or circuit layout - this is to reduce spurious problems by reducing WM
- The element Soggen has a frequency control element that may use a frequency hopping technique and in one embodiment, uses a divided by 2 element to keep it at ~ 50% duty cycle signal. The frequency hopping is at a rate faster than the data/symbol rate of the incoming RF signal.
- After the regenerative divider the signal has a large frequency component at the RF carrier frequency. The regenerative divider also may consist of a divided/multiplied by N element.

7. Who is/are the inventor(s)? Please provide their name(s), address(es) and citizenship.

Tajinder Manku - Canadian
263 Lion's Court
Waterloo

8. What key words would you suggest be used in searching for patents covering similar technology?

Direct conversion receivers
Regenerative dividers
Down conversion
DC offset correction

Embodiments of the invention include:

- In a multi-stage mixer topology, the product of local oscillator signals having significant power at a desired up or down conversion frequency, but each said local oscillator

signals having a little power at said desired up or down conversion frequency, the improvement comprising the steps of:

minimizing unwanted power at base band by increasing the value of: (wanted power minus unwanted power).

- In a multi-stage mixer topology, the product of local oscillator signals having significant power at a desired up or down conversion frequency, but each said local oscillator signal having a little power at said desired up or down conversion frequency, the improvement comprising the steps of:
minimizing unwanted power at base band by adjusting the frequency of one of said local oscillator signals such that the unwanted RF tone does not fall on top of the wanted signal at base band.
- In a multi-stage mixer topology, the product of local oscillator signals having significant power at a desired up or down conversion frequency, but each said local oscillator signals having a little power at said desired up or down conversion frequency, the improvement comprising the steps of:
minimizing unwanted power at base band by frequency hopping one of said local oscillator signals so that the probability of the unwanted RF tone falling on top of the wanted base band signal is significantly reduced.
- A method of control for multi-stage mixer topology comprising the steps of:
minimizing unwanted power at base band by increasing the value of: (wanted power minus unwanted power).
- A method of control for multi-stage mixer topology comprising the steps of:
minimizing unwanted power at base band by adjusting the frequency of one of said local oscillator signals such that the unwanted RF tone does not fall on top of the wanted signal at base band.
- A method of control for multi-stage mixer topology comprising the steps of:
minimizing unwanted power at base band by frequency hopping one of said local oscillator signals so that the probability of the unwanted RF tone falling on top of the wanted base band signal is significantly reduced.

- A multi-stage mixer topology including a pseudo-local oscillator signal generator comprising:
 - a local oscillator that is not tuned to the carrier frequency; and
 - a regenerative divider.
- A multi-stage mixer topology including a pseudo-local oscillator signal generator comprising:
 - a local oscillator that is not tuned to the carrier frequency; and
 - an n-element divider.
- A multi-stage mixer topology including a pseudo-local oscillator signal generator comprising:
 - a local oscillator that is not tuned to the carrier frequency; and
 - an n-element multiplier.
- A mixer comprising:
 - internal switches for changing the gain of said mixer.
- A signal synthesizer for generating local oscillator signals for use in a modulator or demodulator comprising:
 - a divide by two element to ensure that a fifty percent duty cycle is provided.
- A signal synthesizer for use in a multi-stage mixer comprising:
 - a frequency controller enabling the hopping from one frequency to another reducing the probability of the output of said multi-stage mixer having power at an unwanted frequency.
- A system for executing the method of any one of the above embodiments.
- An apparatus for executing the method of any one of the above embodiments.
- A computer readable memory medium for storing software code executable to perform the method of any one of the above embodiments.

- A carrier signal incorporating software code executable to perform the method of any one of the above embodiments.
- A data structure comprising the output data of any one of the above embodiments.

document no.: 150157

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